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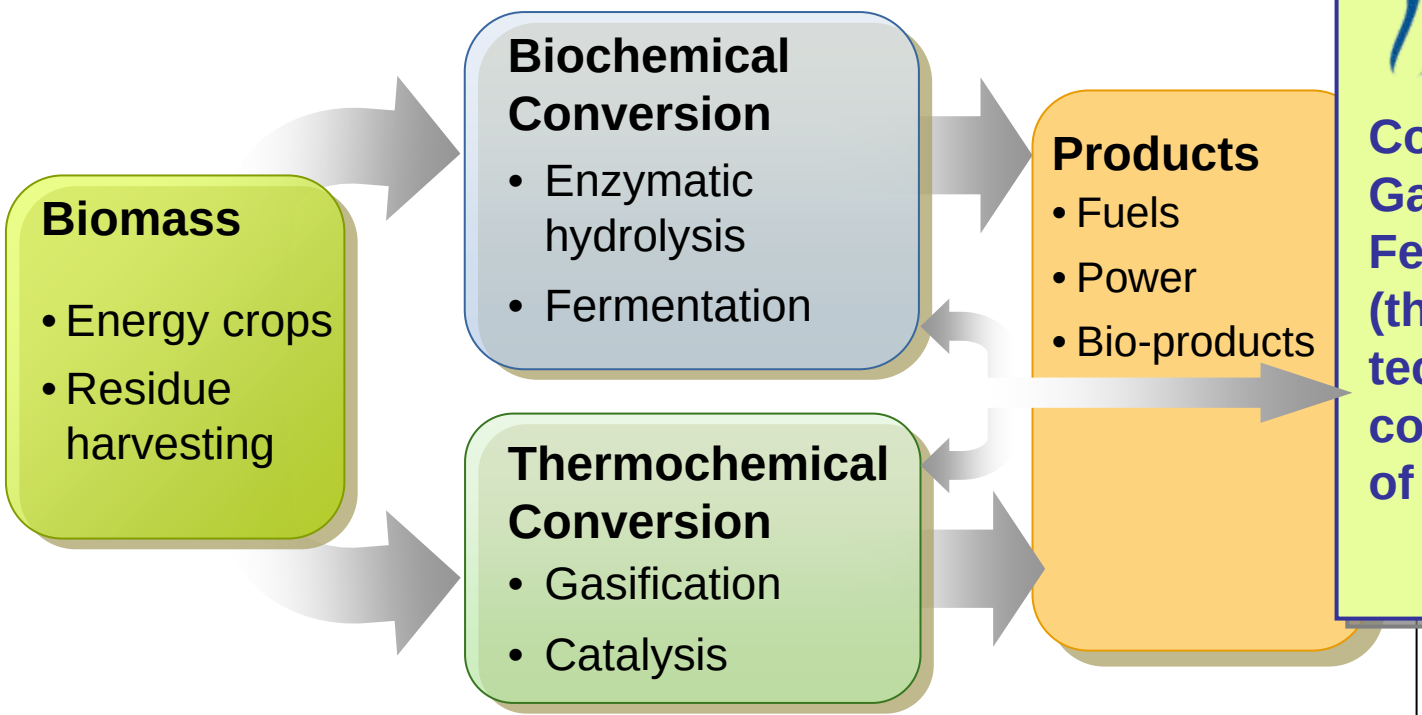
The Leader in Feedstock Flexible Ethanol

US DOE - Biomass 2009

Bill Roe
President & CEO
Coskata, Inc.

Flex Ethanol will involve several technologies

DOE is targeting 2 major pathways for cellulosic biofuels



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Coskata's Hybrid Gasification + Fermentation (thermo-biological) technology combines the best of both routes

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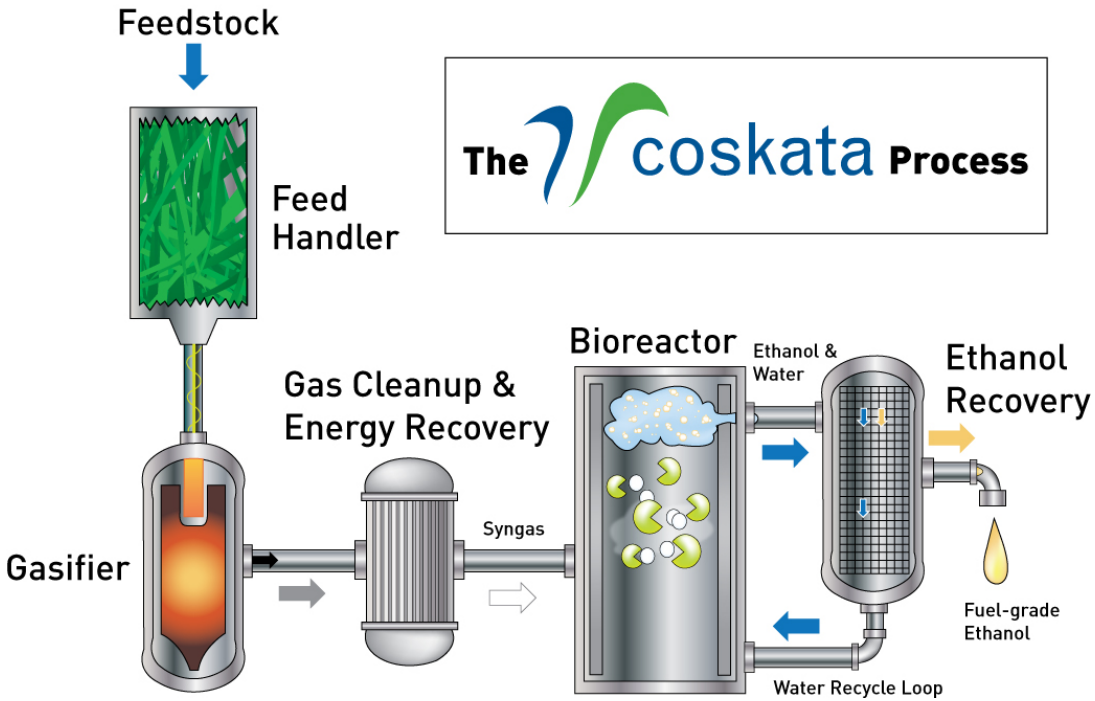
Source: DOE Biomass program presentation to Governor's Ethanol Coalition, Aug. 20, 2008

Coskata has the leading Flex Ethanol™ technology

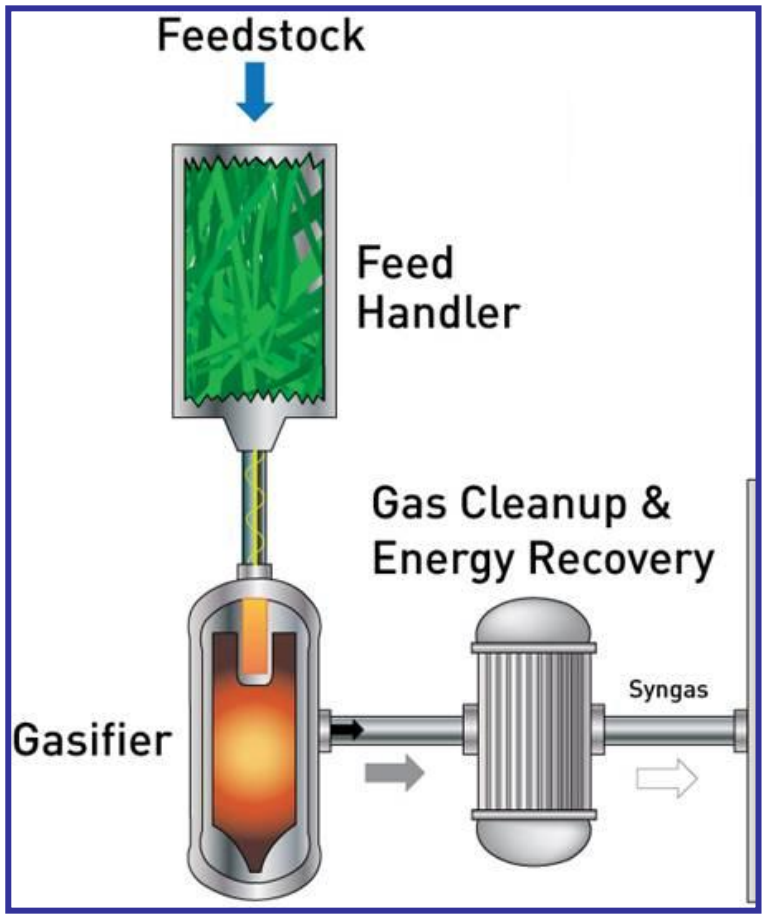


Flexible
- Wide variety of feedstocks
- Geographic diversity

Efficient
- Yields over 100 gal/ton dry biomass
- Produces only fuel grade ethanol

Affordable
- Competitive unsubsidized at oil price of ~$70/bbl

Coskata's process is feedstock flexible by design



Gasification converts carbonaceous feedstock into syngas:

- **Municipal trash** (construction and demolition waste, hurricane debris, plastic, tires)
- **Ag wastes** (corn stover, bagasse, wheat straw, many more)
- **Wood and wood residues**
- **Sustainable energy crops**

Other gas streams can also be converted to ethanol:

- **Steel mill waste gas**
- **Landfill methane gas**
- **Anaerobic digester gas** (manure, current corn ethanol, waste treatment)

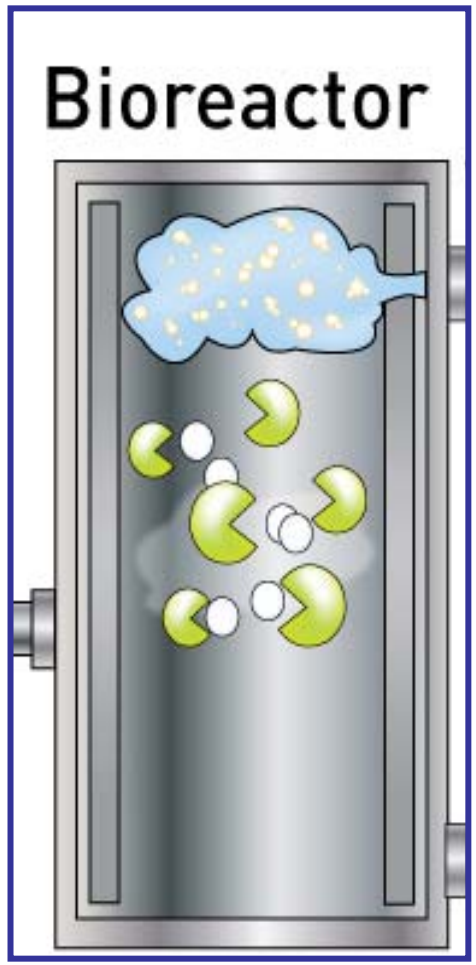
Coskata's proprietary technology drives efficiency

Microorganisms utilize the chemical energy of the syngas to selectively produce ethanol

Proprietary **microorganisms** consume both CO and H2, allowing efficient conversion across the range of H2:CO ratios

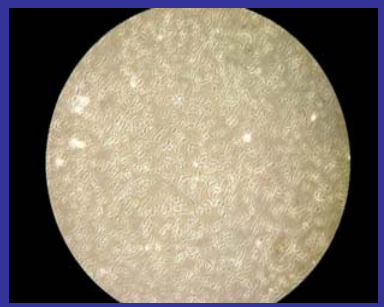
$6\ CO + 3\ H_2O \rightarrow C_2H_5OH + 4\ CO_2$
$6\ H_2 + 2\ CO_2 \rightarrow C_2H_5OH + 3\ H_2O$

Proprietary **bioreactor designs** encourage maximum productivity



Proprietary microorganisms and bioreactor designs

Microorganisms



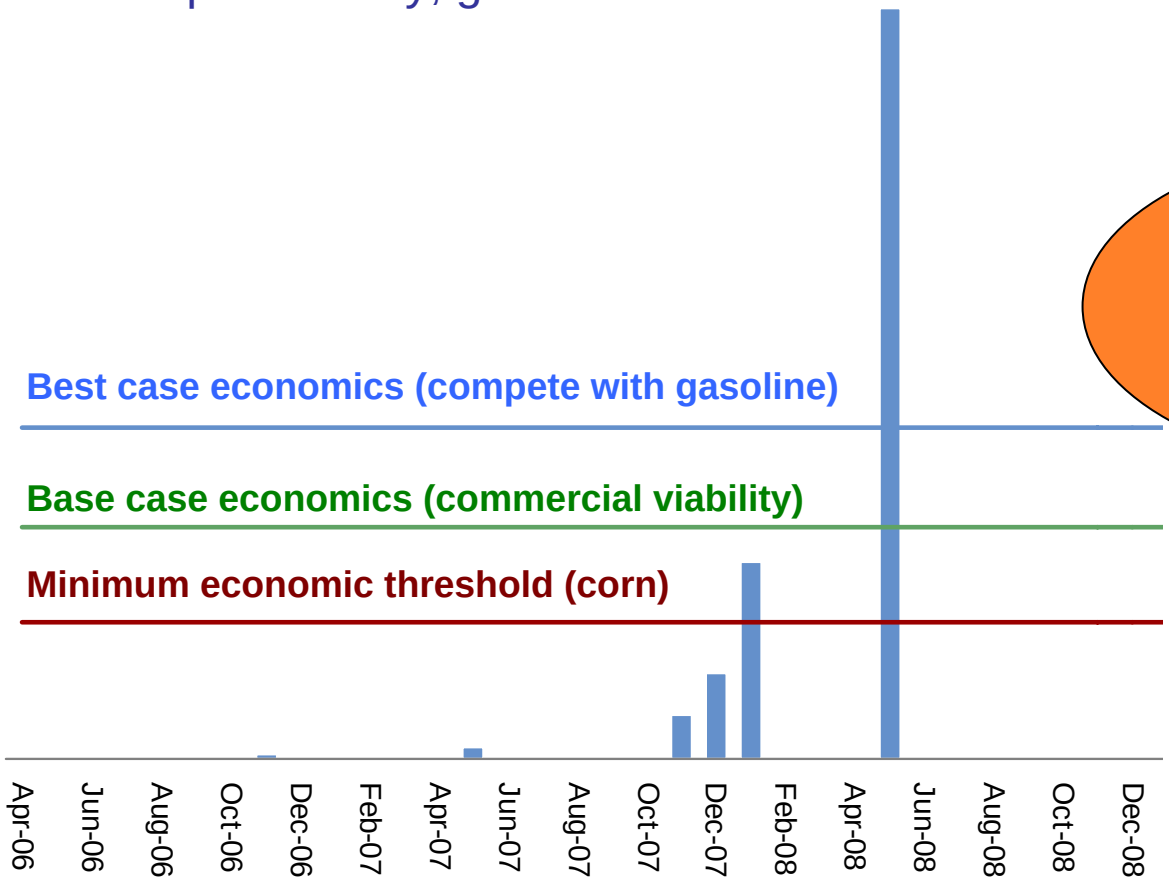
- Anaerobic strains of bacteria originally found in nature have been further developed to perform at the productivity, selectivity, and ethanol tolerance levels needed for process commercialization
- Trace nutrients have been identified and minimized through strain development

Bioreactors

- Several bioreactor designs have been developed that optimize the mass transfer of syngas for conversion
- First commercial plants will employ suspended cell bioreactor designs, while a design employing stationary cells will offer additional advantages in later facilities

Coskata's productivity shows readiness for commercialization

Commercial productivity
Ethanol productivity, g/L/hr



Coskata has achieved target microbe productivity levels

Sandia National Labs study - Key assumptions for biofuels

- **Biofuels conversion technologies**

	Capital cost per gallon capacity	*Yield of ethanol per biomass ton input*
Biochemical		
2010:	$6.16/gal	60 gal/dry ton
2020:	$3.30/gal	88 gal/dry ton
Thermochemical		
2010:	$6.00/gal	75 gal/dry ton
2020:	$4.00/gal	105 gal/dry ton
Biothermal		
2010:	$5.00/gal	90 gal/dry ton
2020:	$3.00/gal	105 gal/dry ton

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- Continued **R&D** needed to ***improve conversion yields***
- **Commercialization** support could ***shrink timeframes*** to maturity
- Both could ***lower capital costs*** significantly

Cellulosic ethanol reduces GHGs even further

DOE analysis targets GHG reduction from ethanol

Gasoline

Petroleum

19% Reduction

28% Reduction

Corn Ethanol

Current Average

Natural Gas

52% Reduction

Biomass

78% Reduction

Sugarcane Ethanol

Biomass

86% Reduction

Cellulosic Ethanol

Biomass

Up to 96% Reduction*

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Biomass

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* As independently estimated by Michael Wang and Argonne National Labs in a GREET study; Based on forest residuals

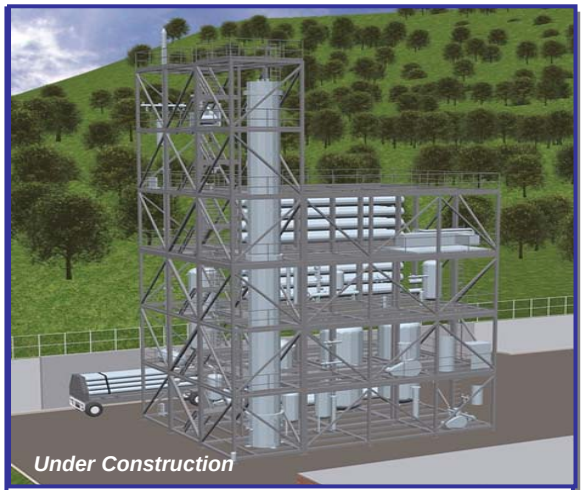
Source: Wang et al, Environ. Research Letters, May 2007; Wang et al, Life-Cycle Energy Use and GHG Implications of Brazilian Sugarcane Ethanol Simulated with GREET Model, Dec. 2007. As presented by DOE August 2008

Coskata is aggressively commercializing

Horizon (Q1 2008)

Integrated Processing
Warrenville, IL

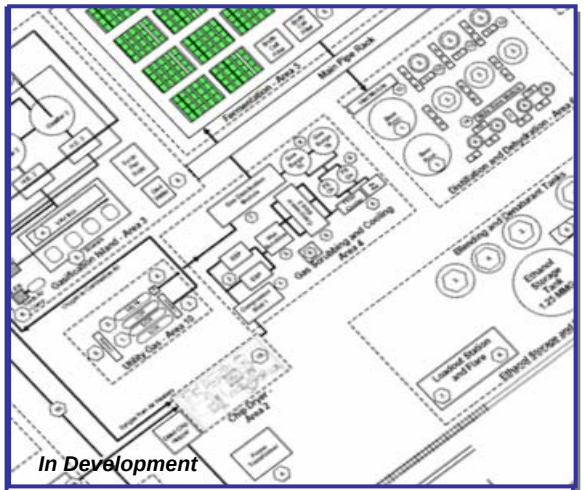
- Integrated processing system with methane thermal reformer, multiple bioreactor designs, and distillation



Lighthouse (2009)

Commercial Demonstration
Madison, Pennsylvania

- Minimum engineering scale (linear scale-up to commercial production)
- Front-end biomass gasifier
- Will test multiple commercial-scale bioreactor and separations designs



Flagship (TBD)

Commercial Production
Location: Southeast US

- Advantaged site selected
- 50-60 MM Gallons / yr
- Multiple gasifiers that process ~1500 dry tons/day of biomass
- Cost competitive with gasoline, unsubsidized, at ~$70/bbl oil

Semi-scale facility proceeding on schedule

Project Lighthouse

- Semi-scale facility in Pennsylvania
- Will demonstrate integrated operation of The Coskata process with gasification
- Will demonstrate industry leading gal/dry ton conversion with multiple bioreactor and separations designs

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Coskata has a flexible commercialization strategy

License

- License technology to development partners including
  - Feedstock suppliers
  - Chemical manufacturers
  - Petroleum companies
  - Ethanol distributors/blenders
  - Project developers
- Enables rapid scale up of technology
- Establishes Coskata as the industry enabler

Own

- Encourages continual process improvements
- Allows Coskata to capture full economic benefits of its technology

Government policy can help jumpstart Flex Ethanol

Make existing programs work

Many programs exist but are not effective in current financial market

- Loan guarantees require **lenders** and limits on review periods and fees
- Cellulosic ethanol tax credits are more effective as refunds or direct payments
- Grants for all scales of commercialization (not just R&D)

Invest in whole supply chain

Investments in up- and down-stream supply chain infrastructure are needed

- Biomass crop supply chains
- Distribution and vehicle infrastructure (including E15, E20 and higher blends)

Enact carbon legislation

Straightforward carbon legislation

- Lifecycle analysis based on sound science and direct, measurable effects
- Credits for all technologies that lower GHG's

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